

CASTANEA

The Journal
of the
Southern Appalachian Botanical Club

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All persons interested in the botany of the Southern Appalachian Mountains are invited to join the club. Dues, including subscription to the Journal, are \$3.00 per year. Single copies of *Castanea*, seventy-five cents.

Notes and short scientific papers relating to the botany of the region are welcomed and will be published to the extent that the size of the Journal allows.

Authors will receive six gratuitous copies of the issue in which their papers appear. Separate reprints, if ordered in advance, will be furnished at cost.

CASTANEA

The Journal of the Southern Appalachian Botanical Club

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Heterostyly in *Piriqueta caroliniana*

JAMES W. HARDIN

Introduction

During the academic year of 1952-53, extensive collecting trips throughout Georgia with Dr. Wilbur H. Duncan afforded excellent opportunities to observe the southeastern flora in its natural setting and form, giving the much needed "3-D" aspect to the species so often seen only on herbarium sheets. Among many interesting observations, distylic forms were found of *Gelsemium sempervirens* (L.) Ait. and *Piriqueta caroliniana* (Walt.) Urban. No description of the heterostyly nature of these two species has been found in the literature. In the early spring a population sample including both style forms was made of *Gelsemium* in Telfair County, Georgia; however, it has been found desirable to wait until further collections are made before a description of the distylic character is presented.

Piriqueta caroliniana (Walt.) Urban (Turneraceae) is found (4) in pinelands and sand dunes, Coastal Plain, Florida to North Carolina. Thorne (6) found it common in sandy pinelands, open woods, and open, grassy places in southwestern Georgia. From the experience of the author, it is common in these habitats as far south as Polk County, Florida. The deep yellow of the corolla is certainly conspicuous, however the plant has been infrequently collected.

Small (4) mentions nothing in his description concerning the distylic nature and in the illustration of the genus shows only the short-styled form. This illustration presumably represents the first of four species, *P. glabrescens* Small, which shares the distylic condition with *P. caroliniana*. Lawrence (2) gives the description of the Tur-

neraceae without mention of heterostyly; however, Willis (7) makes the statement that heterostyly occurs in the family.

Collections of *Piriqueta caroliniana* from Coffee County, Georgia (Hardin, No. 132) were made on May 19, 1953. The distylic forms of the species were readily seen to occur in nearly equal numbers throughout the small populations. Specimens were collected from open, grassy fields by the highway at three stops over a distance of eight miles. In all cases the plants were single or in clonal patches; therefore in collecting, a single plant was taken from each of these clones to give a mass collection from the entire population.

Since no mention of heterostyly in *Piriqueta* has been found in the literature, it is the purpose of this paper to present a description of the flowers and a brief discussion of any possible correlation with vegetative characters.

Historical Account

Since the first description of heterostyled plants by Persoon in 1794, many species have been recognized as being of distylic or tristylic form. Darwin in 1877 (1) presented notes on thirty-eight heterostylous genera of wide distribution, both geographically and phylogenetically. Darwin considered the morphological differences confined to the flower. More recently, however, correlations have been made between the style form and various morphological and physiological characters such as width-length ratio of leaves, shape and size of pollen and stigma, and physiological or genetical incompatibility. These observed correlations complicate the analysis of the genetics of the species, the subject of which has been of primary interest in recent years. Stevens (5) and Mather (3) each go into some detail on the genetics of heterostylous plants.

It is customary to designate the long-styled form as the "pin" type and the short-styled form as the "thrum" type. The phylogenetic significance of these types is intriguing. The heterostylous flower adapted for reciprocal fertilization is a condition essentially the same as that found in dioecious forms, and it is thought that heterostyly is probably a step in evolution toward the dioecious state (5).

Description and Discussion

The flower of *Piriqueta* is perfect and actinomorphic. The calyx consists of five sepals united the lower third of their length and the corolla of five slightly clawed petals. The calyx, hypanthium and pedicel are densely hirsute. The androecium is composed of five distinct stamens borne on the hypanthium and opposite the sepals; the

gynoceum is one-celled with three parietal placentae opposite the styles. The ovary is densely hirsute; style branched and stigmas lobed, thus appearing apically fringed. Within the flower, the only noticeable difference between pin and thrum types is the relative lengths of filaments and styles (ovary size remains constant for both forms), however no actual measurements were taken of the other structures. The illustration (Fig. 1) of the dissected flowers represents a typical for for each type.



Fig. 1. Dissected flowers showing distylic forms. Thrum type left, pin right (X 5).

Measurements taken of stamen and pistil lengths from the forty plants in the mass collection resulted in a pin-thrum ratio of 22:18 or essentially 1:1. Using a ratio of the height of the stamen to the height of the pistil, the average for pin was .58 and for thrum 1.75. Deviations from these means are shown by the scatter diagram (Fig. 2), plotting the length of stamen against that of pistil. The plotted figures indicate the number of flowers having a particular ratio. This clearly establishes the distylic character rather than the tristyllic nature present in some plants.

The leaves of *Piriqueta caroliniana* are variable in shape, margin and size. The shape may be obovate, elliptic, cuneate, lanceolate or rarely oval and the margin repand or crenate-serrate. An analysis of the dimensions of the largest leaf from each of the forty plants showed no correlation between the length-width ratio and the distylic type. The average ratio of the length to width for the pin type was 3.26 and for the thrum 3.35 which certainly shows no significant

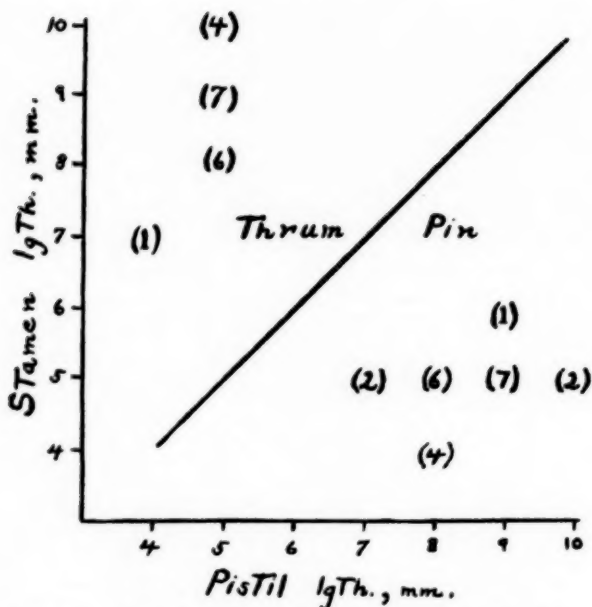


Fig. 2. Scatter diagram showing relationship of distylic forms.

difference. This lack of correlation is of particular interest since a definite relationship was found (5) for this character in *Primula elatior* Hill and possibly in the species of *Lithospermum* (Hardin and Duncan, unpublished).

The genetics of *Piriqueta caroliniana* cannot be ascertained for certain since it is not known if other structural or physiological differences are associated or linked with the heterostyly. As it appears the 1:1 ratio brings to mind the sex ratio which is the best example of this proportion. It is interesting to speculate upon the probability of heterostyly being related in some way to heteromorphic chromosomes. Also interesting is the correlation between this possible interpretation and the theory that heterostyly is a precursor of dioecious plants in the course of evolution. There is certainly much yet to be known about the control of the sex ratio in higher plants and the genetics of heterostyly. If it is true that the pistil and stamen length is the only variable in *Piriqueta*, then the simplicity of heterostyly in this plant may easily be a key to our knowledge of many existing problems.

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- (1) Darwin, Charles. *The Different Forms of Flowers on Plants of the Same Species*. D. Appleton & Co., N.Y. 1877 (Ed. 1896).

- (2) Lawrence, G. H. M. *Taxonomy of Vascular Plants*. Macmillan Co., N.Y. pp. 615-616. 1951.
- (3) Mather, Kenneth. *The Genetical Architecture of Heterostyly in Primula sinensis*. *Evol.* 4:340-352. 1950.
- (4) Small, J. K. *Manual of the Southeastern Flora*. By the Author. pp. 877-878. 1933.
- (5) Stevens, Neil E. *Observations on Heterostylous Plants*. *Bot. Gaz.* 53:277-309. 1912.
- (6) Thorne, R. F. *The Flora of Southwestern Georgia*. Unpublished thesis, Cornell University. 1949.
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DEPARTMENT OF BOTANY
UNIVERSITY OF MICHIGAN

Orchids in Virginia

A. B. MASSEY

Virginia, with its great variety of habitats ranging from the Atlantic Coastal counties over the Coastal Plain and Piedmont to the higher mountains of the Blue Ridge and Alleghanies, supports an equally varied flora.

The orchid flora is especially interesting. Of the 21 genera of the Orchid family described in Gray's Manual (8th ed.), 19 of them are represented in Virginia. Of the 74 species in the Manual, 51 are reported in Virginia, while 9 of the 19 varieties in Gray's Manual are to be found in the state. Except in limited areas, orchids are not abundant. This fact, together with the intricacy and the beauty of the flower, stimulates our interest in them. The greatest majority of the orchids are very exacting as to soil and environment. With few exceptions they are very difficult to transplant; consequently, a high percentage of the attempts at transplanting are failures.

The wise use of the orchids is to enjoy them in their natural setting and avoid disturbing them in any way.

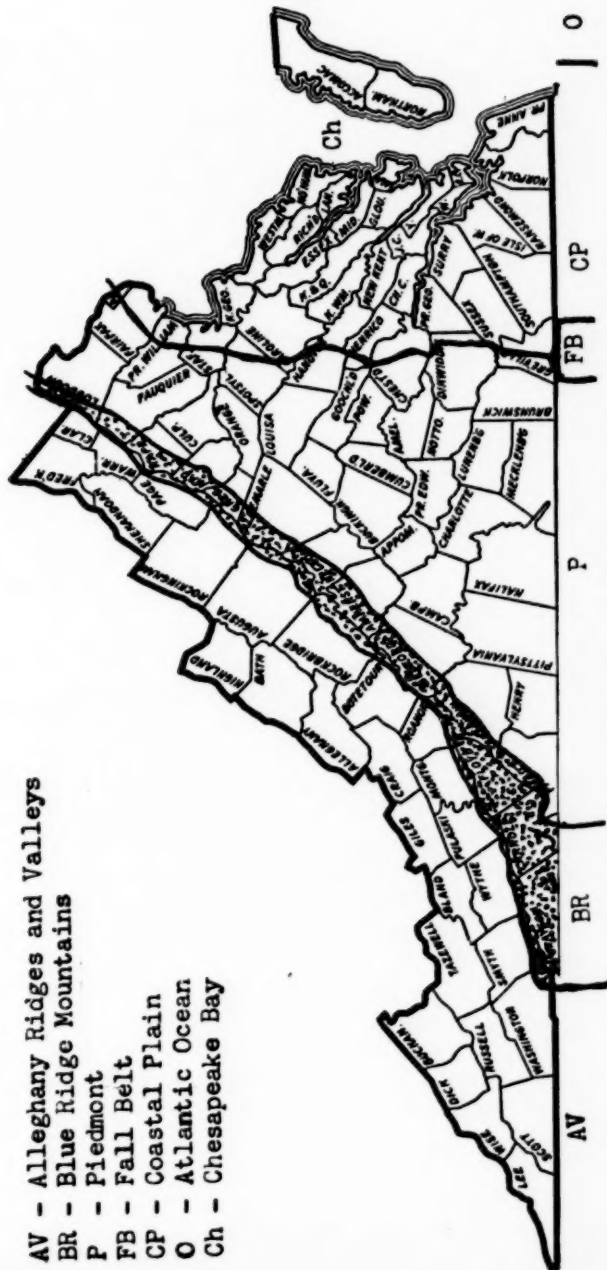
In the accompanying list of the orchids in Virginia, the attempt is made to indicate where they may be expected in the state. The data as to distribution in the state are not complete. That which is given has been taken from printed reports and data received from personnel associated with the several herbaria in the state; namely, Dr. Paul M. Patterson, Hollins College; Col. R. P. Carroll, V.M.I.; Miss Lena Artz, Waterlick; Mr. H. A. Allard, Arlington; Mr. R. C. Mason, Newport News; Miss Jennie Jones, Department of Agriculture and Immigration; Mr. H. W. Hunnewell, Winchester; Dr. E. M. Betts, University of Virginia; Dr. Mary Humphreys, Mary Baldwin College; and the Herbarium of the Virginia Polytechnic Institute.

In presenting the known distribution of species in the state, the first objective has been to indicate the physiographic provinces in which each taxon is known and, secondly, the county.

It is considered that distribution by physiographic regions of the state is more meaningful than by counties; hence, a scheme has been developed to show the recorded occurrence of each species by both physiographic regions and counties. On pages 107-108, the outline of the scheme is shown. The counties of the Coastal Plain province have been numbered 1 through 38; those of the Piedmont, 39 through 60; while the counties of the Mountain province run from 61 through 100. The first three counties of the Coastal Plain have Atlantic Ocean shore line and Chesapeake Bay shore as well. Counties 4 through 11 have Chesapeake Bay influence; 12 through 26 constitute the middle Coastal Plain counties; and 27 through 38 are those along the Fall Belt. The Piedmont province is not subdivided; however, one could recognize the northern and southern or the eastern and western sections of the Piedmont. The northern and southern subdivisions have more ecological significance. It is realized that the placement of some of the counties is debatable as they are partly in two provinces or subdivisions. By referring to the State Geological Map, such counties have been placed according to what seems to be the strongest influence, ecologically. Records from the District of Columbia are designated "DC." It is realized that such may be listed on records in states other than Virginia. Records of collections in the Shenandoah National Park are not listed by counties; hence, the check list indicates the record is "Sh.P." which lies in the Blue Ridge division of the Mountains. An example: *Corallorhiza maculata* is recorded only in the mountains while *C. odontorhiza* occurs in all the provinces of the state.

Some of the species show no Virginia record. Such are included since the range of the species, as given in Gray's *Manual* (8th ed.) and/or Correll's *Orchids of North America*, includes Virginia. The orchid list is based upon Gray's *Manual*. The nomenclature differs, in a few instances, from that of Correll's *Orchids of North America*.

- AV - Alleghany Ridges and Valleys
BR - Blue Ridge Mountains
P - Piedmont
FB - Fall Belt
CP - Coastal Plain
O - Atlantic Ocean
Ch - Chesapeake Bay



Map of Virginia showing physiographic regions

*NUMERICAL DESIGNATION OF COUNTIES OF VIRGINIA
WITH PHYSIOGRAPHIC GROUPING*

<i>Coastal Plain</i>		<i>D.C. Area—</i>	<i>D.C.</i>
<i>Atlantic and Chesapeake (AC)</i>	1. Accomac	<i>Piedmont (P)</i>	
	2. Northampton		39. Brunswick
	3. Princess Anne		40. Mecklenburg
<i>Chesapeake (Ch)</i>	4. Norfolk		41. Halifax
	5. Elizabeth City		42. Charlotte
	6. York		43. Lunenburg
	7. Gloucester		44. Nottoway
	8. Mathews		45. Prince Edward
	9. Middlesex		46. Amelia
	10. Lancaster		47. Cumberland
	11. Northumberland		48. Powhatan
	12. Nansemond		49. Goochland
	13. Southampton		50. Louisa
	14. Isle of Wight		51. Orange
<i>Middle Coastal Plain (MC)</i>	15. Surry		52. Culpeper
	16. Warwick		53. Fauquier
	17. Prince George		54. Loudoun
	18. Charles City		55. Pittsylvania
	19. James City		56. Campbell
	20. New Kent		57. Appomattox
	21. King and Queen		58. Buckingham
	22. King William		59. Fluvanna
	23. Essex		60. Henry
	24. Richmond	<i>Mountains</i>	
<i>Fall Belt (FB)</i>	25. Westmoreland		61. Patrick
	26. King George		62. Franklin
	27. Greensville		63. Bedford
	28. Sussex		64. Amherst
	29. Dinwiddie		65. Nelson
	30. Chesterfield		66. Albemarle
	31. Henrico	<i>Blue Ridge (BR)</i>	67. Greene
	32. Hanover		68. Madison
	33. Caroline		69. Rappahannock
	34. Spotsylvania		70. Grayson
	35. Stafford		71. Carroll
	36. Prince William		72. Floyd
	37. Fairfax		73. Roanoke
	38. Arlington		

Shenandoah National Park	Sh. P.	Valley and Alleghanies (VA)	
	74. Botetourt		84. Bath
	75. Rockbridge		85. Alleghany
	76. Augusta		86. Craig
	77. Rockingham		87. Montgomery
	78. Page		88. Giles
	79. Warren		89. Pulaski
	80. Clarke		90. Wythe
	81. Frederick		91. Bland
	82. Shenandoah		92. Smyth
	83. Highland		93. Tazewell
			94. Washington
			95. Russell
			96. Scott
			97. Lee
			98. Wise
			99. Dickenson
			100. Buchanan

ANNOTATED LIST OF SPECIES

APLECTRUM HYEMALE (Willd.) Torr. Putty root. In humus soil woodlands; flowers in May and June. VA-75-77-82-87-88-92, BR-66, P-52-53-54, FB-29-32-36-37, MC-15-17-19-20, DC.

ARETHUSA BULBOSA L. Arethusa or dragon's mouth. In sphagnum bogs and wet meadows; flowers in June or July. VA-76, BR-61, DC.

CALOPOGON PALLIDUS Chapm. Pale grass-pink. In wet grassy situations and open pine woods; flowers May or June. MC-12-14.

CALOPOGON PULCHELLUS (Salisb.) Ait. Grass pink. In wet acid soil of bogs and swamps; flowers in June or July. VA-76-82-88, BR-72, FB-30, 31, MC-12-17, Ch-4, AC-3, DC.

CLEISTES DIVARICATA (L.) Ames. Rosebud orchid. In moist grassy pine woods and open areas; flowers May or June. VA-86, BR-73, FB-28, MC-12-14-17.

CORALLORHIZA MACULATA Raf. Spotted coral-root. In dry woodlands; flowers in July and August. VA-76-77-88, 89, BR-73, P-53.

CORALLORHIZA ODONTORHIZA (Willd.) Nutt. Late southern coral-root. In dry woodlands; flowers in August and September. VA-77-82-81-89; BR-66-73, P-53-54-46, MC-16-18-19, Ch-7, AC-2, DC.

CORALLORHIZA TRIFIDA, var. *VERNA* (Nutt.) Fern. In swamps and damp thickets; flowers June and July. VA-88.

CORALLORHIZA WISTERIANA Conrad. Spring coral-root. In humus rich soil in broadleaf woods; flowers April and May VA-81, P-53, MC-15, DC.

CYPRIPEDIUM ACAULE Ait. Pink moccasin flower or lady's-slipper. In infertile, acid, organic soil in open wood and shaded situations; flowers in May to July. VA-74-76-77-78-81-82-86-87-88-89-92, BR-61-63-64-65-66-73, P-52-53-54, FB-31-36-37, MC-16-17-19-20, Ch-7-11, AC-3, DC.

CYPRIPEDIUM CALCEOLUS, var. **PARVIFLORUM** (Salisb.) Fern. Small yellow lady's slipper. Correll does not recognize this variety as being distinct from *C. c.*, var. *pubescens*. VA-76-78-82-83-84-86-87-88, BR-63-66-73, P-53, FB-33-36-38, MC-15-19-26.

CYPRIPEDIUM CALCEOLUS, var. **PUBESCENS** (Willd.) Correll. Yellow lady's slipper. In acid organic soil in woodlands, bogs and a variety of situations of variable water content; flowers in July and August. VA-75-78-79-84-86-87-88-92, BR-63-64-66-73, P-46-53, MC-15-19, DC.

CYPRIPEDIUM REGINAE Walt. Queen lady's slipper. In moist limy or neutral moist situations; in bogs or swamps associated often with juniper or arborvitae; flowers in July and August. VA-77-82-92.

GOODYERA PUBESCENS (Willd.) Ait. Downy rattlesnake plantain. In moist woodlands; flowers in July and August. VA-75-76-77-82-84-87-88-89-92, BR-61-64-65-66-70, P-46-53-54-56, FB-27-31-32,37, MC-16-19-20, Ch-4-7, AC-3, DC.

GOODYERA REPENS, var. **OPHIODES** Fern. Rattlesnake plantain. In damp mossy woods in the mountains; flowers in July and August. VA-88-92.

HABENARIA BLEPHARIGLOTTIS (Willd.) Hook. White fringed-orchid. In wet area in meadows, marshes and such situations; flowers June to September. MC-12-13-17.

HABENARIA BLEPHARIGLOTTIS, var. **CONSPICUA** (Nash) Ames. Not recognized by Correll as a good variety; hence it is included in *H. blephariglottis*. FB-28.

HABENARIA CILIARIS (L.) Ait. Yellow fringed-orchid. In variety of moist situations; flowers during July and August. VA-75-76-77-78-82-84-88, BR-61-64-73, FB-30-31, MC-12-16-17-19, DC.

HABENARIA CLAVELLATA (Michx.) Spreng. Small green wood-orchid. VA-76-77-82-84-88-92, BR-64-73, P-46-53, FB-31, MC-16-19-20, Ch-4, AC-2.

HABENARIA CRISTATA (Michx.) Ait. Crested fringed-orchid. In wet soil in various situations; flowers in June to September. MC-12-13-16-18-20, Ch-4, AC-3, DC. (*H.c.* \times *H. ciliaris* = \times *H. chapmanii* (Small) Ames *H.c.* \times *H. blephariglottis* = \times *H. canbyi* Ames)

HABENARIA FIMBRIATA (Ait.) Ait. Listed by Correll as *H. psycodes*, var. *grandiflora* (Bigel.) A Gray. In moist broadleaf woodlands; flowers in July and August. VA-88, BR-70.

HABENARIA FLAVA (L.) Spreng. Yellow rein-orchid. In moist open wood, bogs and marshy places; flowers from May till fall. P-46-48, FB-28, DC.

HABENARIA FLAVA, var. *HERBIOLA* (Ait.) Ames & Correll. Gypsy spike. VA-82, BR-70.

*HABENARIA INTEGR*A (Nutt.) Spreng. Yellow fringeless-orchid. In wet places in acid soil; flowers in July to September.

HABENARIA LACERA (Michx.) Lodd. Ragged fringe-orchid. In open swamps, marshes and moist woodlands; flowers in May and June. VA-76-82, BR-72, P-46-53, FB-31-37, MC-19, AC-3, DC. (*H. lacera* \times *H. psycodes* = \times *H. andrewsii* M. White.)

HABENARIA NIVEA (Nutt.) Spreng. Snowy orchid. In acid soil in wet situations; flowers in May or June.

HABENARIA ORBICULATA (Pursh) Torr. Large round-leaved orchid. In wet or dry woodlands; flowers in June and July. VA-92, BR-70.

HABENARIA PERAMOENA Gray. Purple-spire orchid. In moist meadows and woods along stream banks; flowers June to September. VA-74-75-84-85-88, P-53, DC.

HABENARIA PSYCHODES (L.) Spreng. Small purple-fringed orchid. VA-88-94, BR-70, Sh.P.

HABENARIA VIRIDIS (L.) Br. var. *BRACTEATA* (Willd.) Gray. Long-bracted habénaria. In moist woodlands and other situations; flowers early spring into summer. VA-75-84-92.

HEXALECTRIS SPICATA (Walt.) Barnh. Crested coral root. In dry woodlands; flowers in July and August. VA-82, BR-73, P-46-52, FB-28-29-30, MC-13-19-20.

ISOTRIA MEDEOLOIDES (Pursh) Raf. Smaller whorled pogonia. In leaf mould under trees along streams; flowers in June. MC-19-20, Ch-7.

ISOTRIA VERTICILLATA (Willd.) Raf. Whorled pogonia. In leaf decay of broadleaf woodlands; flowers in May. VA-74-76-77-78-82-87-88-89-92, BR-61-65-66-70, P-46, FB-31, MC-17-19-20, DC.

LIPARIS LILIFOLIA (L.) Lindl. Large twayblade. In woodlands and clearings in sandy soil; flowers in June. VA-74-76-77-82-92, BR-64-66-73, P-39-46-53, FB-31-37, MC-15-16-19-20-26, Ch-9, AC-3.

LIPARIS LOESELII (L.) L. C. Rich. Fen orchid. In bogs and wet meadows; flowers in June. VA-82-92, BR-63-66, FB-31, MC-20, DC.

LISTERA AUSTRALIS Lindl. Southern twayblade. In rich moist humus in woods and other situations; flowers in spring to July. MC-16, AC-3, DC.

LISTERA CONVALLARIOIDES (Sw.) Nutt. Broad-leaved twayblade. In moist organic litter in woods, along stream bank and thickets; flowers in July and August. BR-62.

LISTERA CORDATA (L.) Ait. Heartleaf twayblade. In moist mossy situations in woodlands and bogs; flowers May to August. VA-88.

LISTERA SMALLII Wiegand. Appalachian twayblade. In mountainous areas in moist situations; flowers June to July. VA-92, BR-70.

MALAXIS BAYARDI Fern. Correll treats this as synonymous with *M. unifolia* Michx. On sandy woodland and open areas; flowers in August. MC-12, FB-27.

MALAXIS BRACHYPODA (Gray) Fern. White malaxis. Correll recognizes this as a variety, *M. monophylos*, var *brachypoda* (A. Gray) Morris & Eames and does not include Virginia in its range. Fernald (Gray's Manual, 8th Ed.) states that it ranges southward along the mountains to Tennessee. Its occurrence, however, in Virginia is very doubtful. Moist limy situations at foot of limestone cliffs and in swales; flowers in July.

MALAXIS FLORIDANA (Chapm.) Ktze. Florida adder's mouth. In limy soil on slopes, shores and woodlands; flowers in August Ch-7. (*M. spicata* Sw. in Correll's monograph).

MALAXIS UNIFOLIA Michx. Green adder's mouth. Moist woods, borders of thickets and mossy stream banks; flowers in June and July. VA-76-77-78-82-84-87-88-89, BR-61-63-64-72, P-46-53, MC-15-16-19-20, Ch-7, AC-2-3, DC.

ORCHIS SPECTABILIS L. Showy orchis. In organic soil of broadleaf woodlands; flowers from May to July. VA-70-72-74-77-78-81-82-87-92, BR-64-65-73, P-46-53-56, FB-31-37, MC-15-20, Ch-5, DC.

POGONIA OPHIOGLOSSOIDES (L.) Ker. Rose pogonia. In meadows and swamps; flowers June or July. VA-76-82-87, BR-66-73, FB-31, MC-17-19-20, Ch-4, AC-3, DC.

PONTHIEVA RACEMOSA (Walt.) Mohr. Showy-witch. In wet limy situations; flowers in September MC-13-14-15-19; Ch-4-7.

SPIRANTHES CERNUA (L.) Richard. Nodding ladies' tresses. In moist thickets, bogs and shores, occasionally in dryish situations; flowers in August. VA-77-82-87-88-89, BR-63-66-73, P-41-46-53-56, FB-27-31-38, MC-14-19-20, Ch-4-5, DC.

SPIRANTHES CERNUA, var. *OCHROLEUCA* (Rydb.) Ames. Correll gives this taxon only passing mention since it can be distinguished only by technical study of the seed. In dry open woods, stony slopes; flowers in August.

SPIRANTHES GRACILIS (Bigel.) Beck. Slender ladies' tresses. In infertile soil in open woodlands and dry to moist open areas; flowers in

August. VA-76-77-79-81-82-86-88-89, BR-73, P-46-52-53-56, FB-31-36, MC-12-17-19, AC-3, DC.

SPIRANTHES LACERA Raf. Northern slender ladies' tresses. In moist sandy or sand-clay soil in meadows and thickets; flowers in July.

SPIRANTHES LACINIATA (Small) Ames. Lace-lip spiral-orchid. In shallow water, bogs and marshes; flowers in August.

SPIRANTHES LONGILABRIS, Lindl. Giant spiral-orchid. Not included in Gray's Manual 8th Ed. In wet grassy pinewoods and coastal prairies; flowers in October. Ch-4 (Correll)

SPIRANTHES LUCIDA (H. H. Eaton) Ames. Wide-leaved ladies' tresses. In damp, often limy, shores and rich thickets and meadows; flowers in June. VA-92, FB-36, DC.

SPIRANTHES ODORATA (Nutt.) Lindl. Marsh ladies' tresses. In tidal marshes and shores, not brackish; flowers in September. P-39, FB-27, MC-20.

SPIRANTHES OVALIS Lindl. Oval ladies' tresses. In rich open woods and woodland borders in limy or freestone soil; flowers in June. VA-88-92, FB-27-28-29-30-31, MC-13.

SPIRANTHES PRAECOX (Walt.) Gray. Grass-leaved ladies' tresses. Wet situations in meadows and in open fields; flowers in July. VA-77-82, BR-66, P-46, FB-31, MC-16-20-24, Ch-7.

SPIRANTHES TUBEROSA Raf. Little ladies' tresses. In Gray's Manual 7th Ed. as *S. beckii* Lindl. Correll treats this as a synonym of *S. grayi* Ames. In dry sandy and sand-clay soil in fields and borders of woods and thickets; flowers in August and September.

SPIRANTHES TUBEROSA, var. *GRAYI* (Ames) Fern. Recognized as a species by Correll as *S. grayi* Ames. In dry sandy and sand-clay soil in fields and borders; flowers in August. VA-87, P-39-46.

SPIRANTHES VERNALIS Englem. & Gray. Spring ladies' tresses. In moist to wet situations in fields and clearings; flowers in June and July. P-46, FB-27-31-37, MC-19, AC-3, DC.

TIPULARIA DISCOLOR (Pursh) Nutt. Crane-fly orchid. In broadleaf woodlands; flowers in July. VA-75-82, BR-63-64-66, P-39-45-46, FB-31-37, MC-16-19-20, Ch-4, AC-2-3, DC.

TRIPHORA TRIANTHOPORA (Sw.) Britton. Tree-birds orchid. In rich moist decay in woodlands, edge of stream and marshes. VA-77, BR-63, MC-15.

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A Monograph of *Cabomba*

NORMAN C. FASSETT

This paper had its inception in an expedition to Central America in 1950, made possible by cooperation of the Wisconsin Alumni Research Foundation, the Chicago Natural History Museum, and the Instituto Tropical de Investigaciones Científicas of El Salvador. Material has been examined from the following herbaria: Chicago Natural History Museum (F); the Missouri Botanical Garden (Mo); the Gray Herbarium (GH); the New York Botanical Garden (NY); the United States National Museum (US); and the University of Wisconsin (WIS).

Cabomba is a small genus known only from the warm and temperate regions of the New World. Its systematic position is somewhat uncertain, but it is usually placed, along with *Brasenia*, in a subfamily of the Nymphaeaceae.

Unlike many aquatic plants, *Cabomba* is quite constant in habit, and Figs. 1-8 might, except for certain details in the flowers, serve as an illustration for almost any individual of almost any species.

The plants are always strictly aquatic, completely submersed except for the blossoms at flowering time and, sometimes, a few floating leaves that differ from the submersed ones. The submersed leaves are opposite, or less commonly in whorls of 3, and divided into 5-7 parts at the summit of the long petiole; each part is several times divided, dichotomously and trichotomously, into many long narrow segments.

Basal parts are commonly absent from herbarium sheets and are not usually described. My collection no. 28663 of *C. piahyensis* was from shallow water overlying a soft mud bottom; the lower part of the stem trailed through the mud, with numerous red-brown roots from the nodes. The largest piece collected had 24 cm. of rooting stem and was, like the others, broken off at the end. The plants appeared to be forming large clones which probably fragment with the death of the older stems.

Some variation in width of divisions of the submersed leaves can be observed with the naked eye. With a binocular microscope of 20 or 30 power certain differences appear, which, though minute, are often sufficient to distinguish species.

Floating leaves are very often absent. When present, as in the plant illustrated, they are borne alternately on the stem; the blades are peltately attached to the petioles and have a firm texture like that of a water-lily. They may be very narrow and tapering to the ends

(Fig. 1), or narrow and forked, or broadly oval, like the leaves of *Brasenia*. While there are slight differences in the types of leaves generally produced by each species, and these variations are described under their respective species, they are scarcely constant or distinctive enough to be of diagnostic value.

Flowers vary in color from white to yellow and purple. White flowers may be yellow toward the base of the perianth or purplish toward the margins of the perianth-lobes; in the key the color specified is that of the main part of the sepals and petals.

Flower size seems to be of some diagnostic value. Most of the older descriptions give the width of the open flower, but since these are so rarely seen on herbarium sheets the measurement used here is the length of the unexpanded or recently closed flower.

The 3 sepals and 3 petals are slightly united at base. The petal is divided into blade and claw (Fig. 8); the blade is often auriculate at base. The shape of the petal is one of the most diagnostic characters; unfortunately it can be seen in relatively few herbarium sheets. In this study, a flower has been removed from a sheet, placed on a small piece of cellulose acetate film, softened with a drop of detergent solution, and carefully dissected. To preserve the dissections (since most sheets have very few flowers) they are dehydrated by washing with a few drops of absolute alcohol, then secured to the acetate sheet by the application of a little acetone.

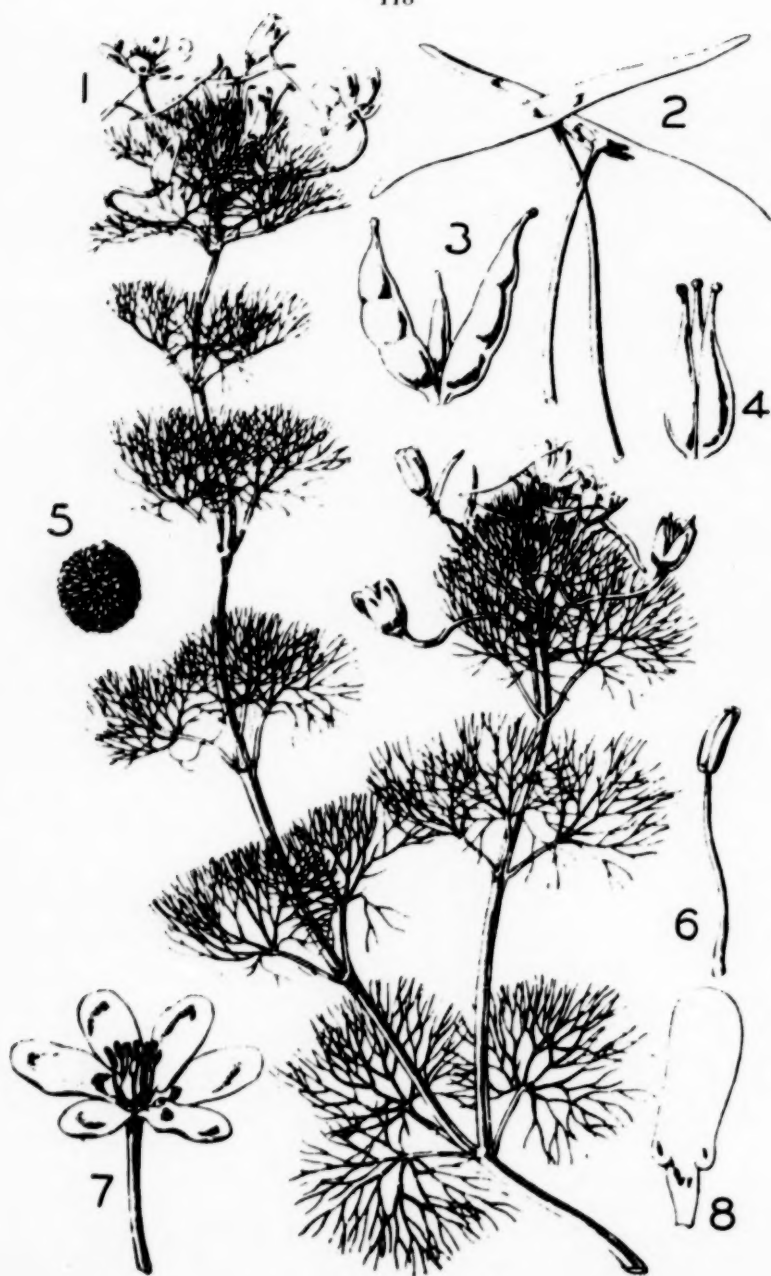
Stamens have been used in the past to help distinguish species, but the proportion of the anther to the filament and the shape of the anther seem to vary with the age of the flower.

Carpels vary from 1 to 4 in each flower, with some strong specific tendencies as to number.

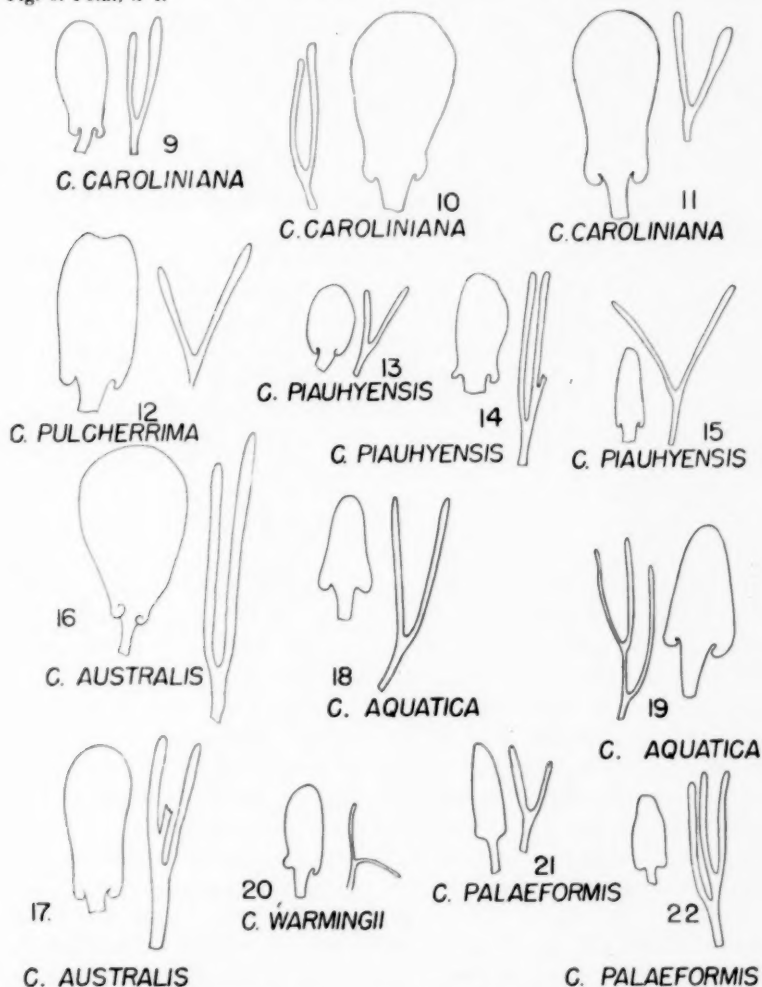
Seeds are elongated (Fig. 5 must be an end view) and covered with elongate processes. They are described as being smooth in some species, but if a seemingly smooth or reticulate seed is soaked in water the hygroscopic processes will swell and become prominent.

Key to Species

- a. Blade of petals auricled toward the base (Figs. 9-20); carpels 2-4; flowers colored or white.
 - b. Terminal divisions of submersed leaves with spatulate tips (Figs. 9-12).
 - c. Perianth segments white or bluish, yellow at base, sometimes purple-margined, rounded at summit (Figs. 9-11) 1. *C. caroliniana*.
 - c. Perianth segments purple, emarginate at summit (Fig. 12) 2. *C. pulcherrima*.



Figures 1-8. *Cabomba piahyensis*; reproduced, with changes in numbering and deletion of one figure, from Hooker's *Icones* 7, plate 641. Fig. 1. Habit, x 1. Fig. 2. Floating leaves, x 3. Fig. 3. Young fruits, x 3. Fig. 4. Carpels, x 3. Fig. 5. Seed (probably an end view), x 6. Fig. 6. Stamen, x 10. Fig. 7. Flower, x 2. Fig. 8. Petal, x 4.



Figures 9-22. Petal and leaf segments, x 3. Fig. 9. *C. caroliniana*. Alabama, Svenson & Harper 9428. Fig. 10. *C. caroliniana*. Connecticut, Eames 11847. Fig. 11. *C. caroliniana*. Kentucky, Seargeant 601. Fig. 12. *C. pulcherrima*. South Carolina, Tryon & Godfrey 1479. Fig. 13. *C. piahyensis*. Venezuela, Killip 37677. Fig. 14. *C. piahyensis*. Trinidad, Britton & Hazen 738. Fig. 15. *C. piahyensis* f. *albida*. Cuba, Wright 1860. Fig. 16. *C. australis*. Brazil, Rut 824. Fig. 17. *C. australis*. Argentina, Parodi 11895. Fig. 18. *C. aquatica*. British Guiana, de la Cruz 4244. Fig. 19. *C. aquatica*. Brazil, Wright in 1935. Fig. 20. *C. warmingii*. Brazil, Hoene 19262. Fig. 21. *C. palaeformis*. Mexico, LeSueur 136. Fig. 22. *C. palaeformis*. British Honduras, Bartlett 12486. All drawings from specimens in the Gray Herbarium.

- b. Terminal divisions of submersed leaves with linear tips (Figs. 13-21).
- d. Divisions of submersed leaves with midvein and with short, longitudinal red lines locally distributed.
- e. Flowers purple (except in albinos), 6-9 mm. long 3. *C. piauihyensis*.
- e. Flowers yellow, 8-12 mm. long. . . 4. *C. australis*.
- d. Divisions of submersed leaves without midvein or other markings.
- f. Submersed leaves opaque, the terminal divisions 0.1-0.4 mm. wide; petals white, yellow toward base, widest below the middle (Figs. 18 & 19) . . 5. *C. aquatica*.
- f. Submersed leaves filmy and translucent, the terminal divisions 0.1 mm. wide; petals purple, with nearly parallel sides (Fig. 20) 6. *C. Warmingii*.
- a. Blade of petals abruptly narrowed to the claw but scarcely auricled (Figs. 21 & 22); carpel one; flowers white . . 7. *C. palaeiformis*.

1. *CABOMBA CAROLINIANA* Gray, Ann. Lyc. N.Y. 4: 46. 1837; T. & G., Fl. N. Am. 55. 1838; Hook. Ic. 7: t. 642. 1844; Gray, Gen. Pl. U.S. 1: 93, 2: 38, 1848; Casp. in Mart., Fl. Bras. 4, pt. 2: 139, t. 38. 1878; Britton & Brown, Ill. Fl. 2: 41. 1897, and ed. 2, 2: 76. 1913; Robinson & Fernald in Grays Manual, ed. 7: 392. 1908; Small, Man. Southeastern Fl. 539. 1933; Fassett, Man. Aquat. Pl. 217. 1940; Muenscher, Aquat. Pl. U.S. 234. 1944; Fernald in Gray's Manual, ed. 8: 642. 1950. *C. aquatica* Schultes f., Syst. 7. 1378. 1830, in part. *Nectris aquatica* Pers. Syn. Pl. 394. 1805, in part; Ell., Sketch 1: 416. 1817.

Flowers 7-11 mm. long; petals rounded at tip, slightly wider above the middle, white, yellow on the auricles and sometimes purplish-tinged on the margins; carpels 2-4; stem with dense red tomentum on the uppermost unelongated internodes; terminal divisions of submersed leaves slightly spatulate, 0.3-0.8 mm. wide near the tip and slightly narrower toward the base, sometimes with red flecks or short lines, the midrib obscure or obsolete; floating peltate leaves 1.5-2.5 mm. wide, entire or somewhat sagittate at base.

South-central Texas to southern Florida, northern Kentucky, and rarely to southern Michigan, and in the Atlantic States to New York, southern Connecticut and southeastern Massachusetts; adventive northeast of Virginia according to Fernald in Gray's Manual,

ed. 8. Map 1.



Map 1. Distribution of *C. caroliniana*

2. **CABOMBA pulcherrima** (Harper) n. comb. *C. caroliniana* var. *pulcherrima* Harper, Bull. Torrey Club 30: 328. 1903.

Flowers purple, 7-10 mm. long; sepals and petals emarginate at tip; carpels 3-4; stem with dense red tomentum on the uppermost unelongated internodes; terminal divisions of submersed leaves 0.1-0.4 mm. wide near the top and slightly narrower toward the base, often with red flecks or lines, the midrib obscure or obsolete; floating peltate leaves 1.5-3 mm. wide.

At low altitudes from southern South Carolina, southwestern Georgia and adjacent Florida. Map 2. SOUTH CAROLINA: Walterboro, Colleton Co., 14 August 1939, *Tryon & Godfrey* 949 (F, GH, MO, NY); Bluffton, November 1879, *Mullichamp* (GH). GEORGIA: Cane Water Pond, Decatur Co., 13 August 1901, *Harper* 1209 (TYPE NUMBER: GH, MO, US). FLORIDA: Tallahassee, Leon Co., 4 August 1937, *Weigand & Manning* 1182 (F, GH); Apalachicola, July, *Biltmore Herbarium* 1701a (MO, GH); Lac. Jamony, Tallahassee, May-June 1843, *Rugel* (MO, NY).



Map 2. Distribution of *C. pulcherrima*

3. *CABOMBA PIAUHYENSIS* Gardn. in Hook. Ic. 7: t. 641. 1844; Casp. in Mart., Fl. Bras. 4, pt. 2: 141, t. 37. 1878. *C. pubescens* Ule, Notizbl. Bot. Gart. Berlin 4: 293. 1915.

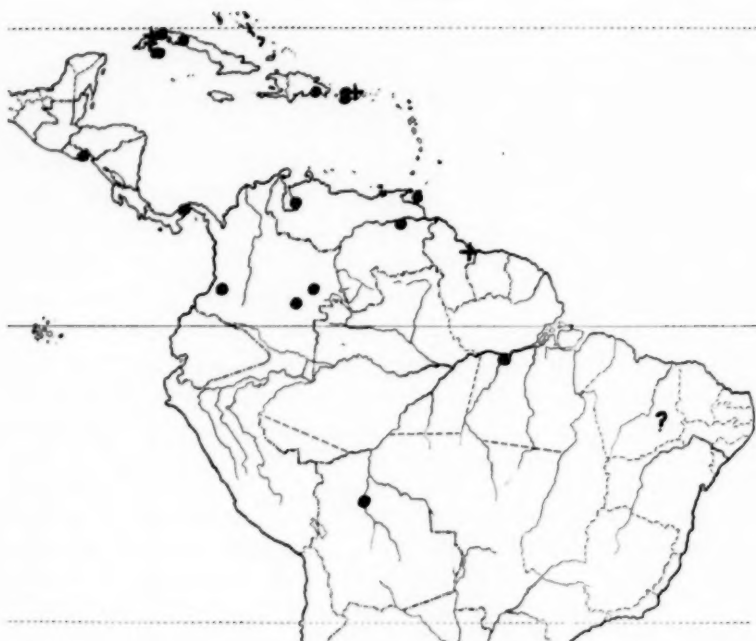
Flowers 6-9 mm. long, pink or purple, yellow toward the center; petals with nearly parallel sides, auriculate; carpels 2-3, glabrous or obscurely pubescent; young internodes somewhat reddish-tomentose to glabrous; floating leaves rare, broadly elliptic, about 1 cm. wide,

or very narrow; terminal divisions of submersed leaves 0.1-0.3 mm. wide, linear, with a midrib and short red lines paralleling it.

Northern Brazil and Bolivia northward, to Cuba in the West Indies and to El Salvador in Central America; mostly at low altitudes. Map 3. CUBA: Santa Clara, July 1941, *Howard* 5558 (GH), Laguna Ariguanabe, Prov. Havana, 28 December 1910, *Wilson* 9573 (GH); Jucare, Isle of Pines, 20 February 1916, *Britton*, *Britton* & *Wilson* 14631 (F, MO, GH, NY). PUERTO RICO: Aguadilla, 14 December 1886, *Sintesis* 5766 (F, MO, GH, NY); Añasco, 7 December 1886, *Sintesis* 5601 (F, MO, GH, NY). BRITISH WEST INDIES: Trinidad, Dabadie, 18 March 1920, *Britton* & *Hazen* 738 (US, GH, NY). EL SALVADOR: Laguna de Maquigüe, Dept. de La Unión, 18 February 1922, *Standley* 20955 (F, GH); Laguna Maquigua (or Maquigüe), 18 km. west of La Unión, 13 January 1951, *Fassett* 28633 (F, GH, WIS); Laguna Maniguara, 18 km. west of La Unión, 13 January 1951, *Fassett* 28661 (F). PANAMA: between Panamá and Chepo, 29 November 1934, *Dodge et al.* 16709 (MO); Matías Hernandez, November 1914, *Pittier* 6858 (US, GH, NY); Changres River between Gambia and Madden Dam, June 1937, *Curry* (MO); Madden Lake, 3-20 August 1940, *Woodson* & *Schery* 951 (US, NY). COLOMBIA: Río Meta, Orocué, 3 November 1938, *Cuatrecasas* 4384 (F, US). VENEZUELA: Bolívar, Paso de Cardozo, 10 km. south of Ciudad Bolívar, 27 & 28 April 1942, *Killip* 37677 (F, US, GH); Acarigua, 9 July 1941, *Salazar* 24 (US). BRAZIL: Taperinha bie Santarem, 9 June 1927, *Ginzberger* 656 (F); Prov. Piahy, *Gardney* 2478 (TYPE NUMBER; US); Santarem, Prov. Pará, April 1850, *Spruce* (GH). BOLIVIA: Trinidad, 1922, *Cardenas* 11 (US, GH, NY).

CABOMBA PIAUHYENSIS f. *albida*, n.f., floribus albis. CUBA: near Vento, Prov. Havana, 8 January 1901, *van Hermann* 423 (F); San Mateo near Pinar del Rio, *Wright* 1850 (GH, MO, NY); Isle of Pines, 21 October 1920, *Ekman* (F). PUERTO RICO: Vega Baja, 24 March 1922, *Britton*, *Britton* & *Brown* 6761 (TYPE in NY; US). BRITISH GUIANA: Kitty Village, 1922, *Dahlgren* & *Persand* (F).

C. piauhyensis is variable in several respects. The petals are widest above the middle (Figs. 13, 14) or below the middle (Fig. 15), with no clear line of distinction. The terminal segments of the submersed leaves may be 0.3 mm. wide with well-marked red lines, or as narrow as 0.1 mm. with the red lines few and visible only with fairly high magnification, 20 or 30 times. The anthers may be several times as long as wide, or nearly round; this is perhaps a matter of age.



Map 3. Distribution of *C. piahyensis*

The specific name was originally published as *Piahyensis*, but is now often written *piahiensis*. In the *Flora Brasiliensis* it is spelled with an *i* in the text and with a *y* on plate 37.

The name of the province itself is spelled *Piauhy* on a map copyright in 1850,¹ and *Piauhí* on one copyright in 1855.² It appears as *Piauí* in the latest maps.³ Prof. Eduardo Neale-Silva, of the Department of Spanish and Portuguese in the University of Wisconsin, tells me that Brazilian Portuguese has had numerous reformations and alterations in spelling, and that each may be considered as correct in its day. The case appears to be parallel to that of the specific epithet *pensylvanicus*,⁴ in that *piahyensis* followed the approved spelling of its day (or an approved spelling) and is not subject to orthographic correction with subsequent changes of Piauhy to Piauhí or Piauí.

¹ New Universal Atlas. Thomas, Cowperthwait & Co. 1852.

² Coltons General Atlas. 1861.

³ Map of the Americas, 1:5,000,000. American Geographical Society of New York. 1942, revised 1944.

⁴ See *Rhodora* 43: 220. 1941.

4. *CABOMBA AUSTRALIS* Speg., Anal. Soc. Cient. Argent. 10: 219. 1880.

Flowers 8-12 mm. long, white, yellow toward the center; petals oblong, obovate, broadly rounded at summit, the blade narrowed below the middle and auriculate at base; carpels 2-3, glabrous; young internodes red-tomentose; peltate floating leaves 1-1.5 mm. wide; terminal divisions of submersed leaves 9.3-0.6 mm. wide, linear, with often copious red lines.

Southern Brazil to Paraguay and eastern Argentina. Map 4.

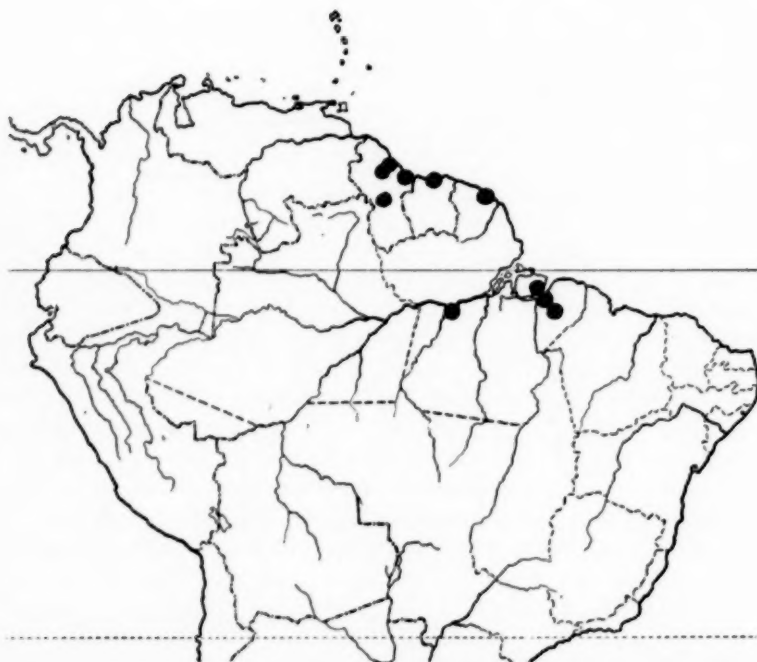


Map 4. Distribution of *C. australis*

5. *CABOMBA AQUATICA* Aubl., Hist. Pl. Guian. Franc. 1: 321, t. 124. 1775; Lam., Tab. Encyc. 2: 398, t. 265. 1793; DC., Syst. 2: 36. 1821, in part; DC., Prod. 1: 112. 1824; Gray, Ann. Lyc. N.Y. 4: 46. 1837; Schnizlein, Iconogr. 3: t. 186. 1854; Casp in Mart., Fl. Bras. 4, pt. 2: 138, t. 37. 1878, excluding plant from Vera Cruz; Curtis, Bot. Mag. 115: t. 7090. 1889. *Nectris aquatica* Willd., Sp. Pl. ed. 2: 248. 1799.

Flowers 4.5-10 mm. long, yellow; petals with blade triangular-lanceolate, strongly narrowed toward the summit and auricled at base; sepals yellow, sometimes tinged with purple toward base or summit; carpels 2 (-3), glabrous or lightly red-pubescent; young internodes yellow-tomentose; floating peltate leaves broadelliptic, 1-2 cm. wide, rarely very narrow, often absent; terminal divisions of submersed leaves 0.1-0.4 mm. wide, linear, without nerves or red markings.

British Guiana to the lower Amazon River. Map 5. BRITISH GUIANA: Kamuska, Upper Mazaruni River, 11-12 July 1923, *De La Cruz* 4424 (GH, NY, US, F, MO); Pomeroon District, Moruka River, July 1927, *De La Cruz* 4569 (F, GH, MO); Bartica, on the Essequibo River, 3-12 September 1922, *De La Cruz* 1954 (GH, NY, US, F, MO). DUTCH GUIANA: Forest of Plantation, La Poule, 23 April 1916, *Samuels* 97 (F). BRAZIL: Thomé Assú, Dist. Acara, 24 July 1931, *Mexia* 5966 (F, MO, GH); Taperinka bie Santarem, 9 June 1927, *Ginzberger* 655 (F).



Map 5. Distribution of *C. aquatica*

The drawings accompanying the original description of *C. aquatica* show petals without basal lobes, as in *C. palaeformis*. Since the drawings are somewhat stylized and inaccurate in many details, they may be discounted, particularly in view of the fact that no *Cabomba* has been seen from South America with a petal of this shape. *C. aquatica* is described as having yellow flowers, and it is the only yellow-flowered *Cabomba* in this part of the world.

6. *CABOMBA WARMINGII* Casp. in Mart., Fl. Bras. 4, pt. 2: 142. 1878.

I have seen but one sheet, other than the very different *C. australis*, from southern Brazil, the type region for *C. Warmingii*. This is from Ponso Algere, *Hoene 19262* (GH). The aspect is very different from that of *C. aquatica*, but the tangled mass of very narrow filmy leaf-divisions is not easy to describe in contradistinction to the firmer leaves of *C. aquatica*. To the naked eye, the pressed plant suggests a very fine and delicate *Nitella* much more than a *Cabomba*.

C. Warmingii is listed by Caspary from Lagoa Santa in Minas Geraes, and from Velhas River not far from Sabara.

7. *CABOMBA palaeformis* n. sp.

Floribus 6-8.5 mm. longis; petalis albis, purpureis ad basim, oblongis-lanceolatis, laminis angustatis subito ad basim sed vix auriculatis; carpello solitario.

Flowers 6-8.5 mm. long; petals white, sometimes tinged with yellowish and purplish at base, oblong-lanceolate, the blade abruptly narrowed but scarcely auricled at base; carpel solitary; submersed leaves with red lines and purple flecks, the terminal divisions 0.2-0.5 mm. wide, linear or slightly spatulate.

At low altitudes, southern Mexico to Guatemala (Map 6). MEXICO: Temesi River at Altamira, 3 June 1939, *LeSueur 136* (F, NY, GH, US); Tampico, 27-30 April 1910, *Palmer 311* (TYPE in GH; MO, F, NY, US); Hucjutla, 1841-42, *Karwinsky 903* (F); Las Garzas, Acapet[agua], Chiapas, January 1939, *Matuda 2703* (F, GH, MO); Reforma, Balacan, Tabasco, 22-26 May 1939, *Matuda 3191* (F, NY, GH); Campoton, Campeche, 7-15 July 1932, *Steere 1176* (F); Chan Laguna, Campeche, 4 December 1931, *Lundell 1024* (MO, NY, US). BRITISH HONDURAS: Belize River near Belize, 11 March 1933, *Lundell 1817* (F); Jacinto Creek, Muchada, 29 February 1932, *Schipp & Sumner 1136* (F, MO). GUATEMALA: El Paso, Petén, San Pedro River, 17 April 1932, *Lundell 1502* (F); Dept. Izabel, El Golfete de Río Dulce, Cayo Piedra, 21 December 1941, *Steyermark 41753* (F); Lake Izabel, 14 May 1937, *Muenschner 12611* (F); Santa Teresa, Subin River, Petén, 10 April 1933, *Lundell 2755* (F).



Map 6. Distribution of *C. palaeformis*

Perhaps a primitive species, with the auricles of the petals poorly developed. The shape of the terminal segments of the submersed leaves is intermediate between that of the species of the United States and that of species of the West Indies, South and Central America.

UNIVERSITY OF WISCONSIN

The varieties of *Monarda fistulosa* L.

F. R. FOSBERG AND LENA ARTZ

In their revision of the genus *Monarda* (Univ. Calif. Pub. Bot. 20: 1942, on pp. 165-168), McClintock and Epling do not separate varieties in the variable species, *Monarda fistulosa*, except for the cultivated var. *rubra*. Fernald (Rhodora 46: 394-396, 1944) criticized the reviewers for not separating var. *mollis* (L.) Benth. from the typical form, pointing out that var. *mollis* has been recognized as a distinct form by many botanists, none of them splitters. McClintock and Epling, however, do give information that seems to provide justification for recognizing the var. *mollis* of Linnaeus as distinct, varietally, from the typical form. The latter they regard as the form with sparse straight soft pubescence, much more restricted, geographically, than var. *mollis*. They point out that intergrades exist between these two. From their discussion of these, and from examination of the large series of herbarium material in the U.S. National Herbarium, it seems to us that these may result from introgressive hybridization, or possibly that there may actually be several

other genetic entities than those recognized here. Only intensive biosystematic work and, perhaps, garden culture will clarify the situation with regard to these local forms. This genus, by the way, seems admirably adapted to investigation by these methods, as it is commonly abundant in the field, conspicuous, and an attractive and easily grown garden plant.

A population of plants found by the junior author on the high talus slopes and cliffs of the southern entrance to the Smoke Hole, in the West Virginia mountains, attracted attention because of several distinctive characteristics. It obviously belongs in *M. fistulosa* as treated by McClintock and Epling, though it will not run to this species in the key to *Monarda* in the 8th edition of Gray's Manual. It falls, in most respects, within the range of variation allowed for *M. fistulosa* by McClintock and Epling, though the curious calyx lobes do not seem to be duplicated in that species and are not mentioned in their description.

Plants from this population have been transplanted to Fort Valley, Massanutten Mts., Virginia, and are growing well in the junior author's garden and maintaining their characters there. The most obvious distinguishing marks of this form are its low stature, and its firm, dark green, only slightly serrate leaves, as well as the pustulate glandular calyx lobes.

A brief outline of the varieties of this species follows, with a description of the new one.

MONARDA FISTULOSA L. var. FISTULOSA

Plants generally, though sparsely, spreading pilose, stature tall, 4-10 dm., calyx glandular but not conspicuously pustulate, flowers pink or lavender to whitish, corolla lips comose, especially the upper one.

Distributed from southern New York, New Jersey, and Pennsylvania south in the Appalachians to North Carolina, with outliers in Southern Ohio and a single collection from Missouri.

MONARDA FISTULOSA var. RUBRA Gray, Syn. Fl. 2: 374, 1878.

Pubescence of slender hairs, thin below, denser and more appressed on smaller branchlets, definitely appressed on leaves, stature 1 m. or more tall, flowers deep rose-purple, corolla 25-33 mm. long, upper lip comose, lower glabrous, with a long central tooth.

Usually a cultivated plant, but originally described from wild material from Roan Mt., Tennessee, also found wild in the mountains of western North Carolina, but rare.

MONARDA FISTULOSA var. MOLLIS (L.) Benth. Lab. Gen. Sp. 317, 1833.

Monarda mollis L. Amoen. Acad. 3: 399, 1756.

Generally pubescent with short curled or downwardly curved hairs, usually presenting a slightly cinereous, canescent, or even somewhat velutinous appearance in dried specimens, stature tall, 4-10 dm., calyx glandular but not pustulate, flowers generally pink or lavender, or whitish, both lips of corolla usually comose.

Wide ranging, southern New England to Louisiana and Texas, west to Nebraska and eastern Dakotas, absent from the Atlantic Coastal Plain and much of the Piedmont, rare on the Gulf Coastal Plain.

MONARDA FISTULOSA var. MENTHAEFOLIA (Graham) Fernald Rhodora 46:495, 1944.

Monarda menthaefolia Graham Edinb. New Phil. Journ. 387, 1829.

Monarda mollis var. *menthaefolia* (Graham) Fernald Rhodora 3: 15, 1901.

Distinguished by its stiffer and mostly simpler and lower stems and shorter-petioled leaves, from var. *mollis*, into which it passes insensibly in the eastern part of its range.

Great Plains and Rocky Mountains, extending eastward to Manitoba and Minnesota.

MONARDA FISTULOSA var. *brevis* Fosberg & Artz, n. var.

Planta parva, 3 dm. alta, caulis vix pubescentis, foliis glabris subserratis, lobis calycis pustulato-glandulosis labiis corollae comosis.

Low plants, uniformly about 3 dm. tall, stem slightly pubescent with short downward curved hairs, especially at nodes; leaves ovate, mostly obscurely serrate, firm, dark green, glabrous on both sides, petioles 2-11 mm. long, heads, exclusive of the corollas, 15-20 mm. across, calyx tubes up to 7.5 mm. long, lobes rigid, subulate acuminate, 2 mm. long conspicuously pustulate glandular, the dark glands set up on conical projections giving an irregular appearance to the lobes, tube pectinate-ciliate, the hairs pointing downward externally, strongly bearded within, corollas about 25 mm. long, pale lavender, thinly pilose externally, more so (comose) at tips of both lips.

West Virginia: Pendleton Co.: talus at base of limestone cliff on mountainside above right bank of South Branch of the Potomac River, near southern entrance to Smoke Hole, June 27, 1953, *Lena Artz 1232* (U.S. Nat. Herb., type; Herb. W.Va.U.)

FALLS CHURCH, VA.

WATERLICK, VA.

NOTES and NEWS

VIOLA appalachiensis, nom. nova, a substitution for *Viola allegheniensis* Henry.

I inadvertently overlooked the reference to *Viola alleghanensis* Roemer and Schultes (Index Kewensis, fasc. 4, p. 1205, 1895). In order to avoid future confusion, I propose the name *Viola appalachiensis* for this taxon, as published in "Castanea," vol. 18: 53-55, 1953.—L. K. Henry.

CHARLES MOORE ROBERTS, Professor of Botany at Fairmont State College, Fairmont, W.Va., died November 9, 1953. He was born at Corry, Pennsylvania, in 1894, the son of the late Berton O. and Kate Middleton Roberts. He received the B.S. and M.S. degrees from Pennsylvania State College in 1924 and 1925. He did further graduate work at the University of Michigan, University of Pittsburgh, Cornell University, and West Virginia University. Mr. Roberts came to Fairmont in 1926 after having served a year as instructor at the University of Washington. He was a member of the Sullivant Moss Society, the Phi Epsilon Phi honor society, the Kappa Sigma Kappa social fraternity, the state and national education associations, Kiwanis, and Christ Episcopal Church. He is survived by his wife, Katherine Hammond Roberts, and a daughter, Emily Wells Roberts, a senior in Fairmont State College.

Mr. Roberts studied extensively in the field of the Bryophyta. His collection of the mosses of Pennsylvania and West Virginia is outstanding. The memory of Mr. Roberts as a scholar, teacher and friend will be cherished by students, colleagues, and all others who knew him.—GEORGE R. HUNT, DEAN, FAIRMONT STATE COLLEGE.

BOOK REVIEWS

A NEW FLORA OF COLORADO*.—The appearance of William A. Weber's new book on the flora of the Colorado Front Ranges will be welcome to the many tourists who are annually fascinated by the lovely flowers of the region, and who have found unsatisfactory the older treatments of the plant life of Colorado. The present book gives keys for the identification of the ferns, conifers, and flowering

*Handbook of plants of the Colorado Front Range. William A. Weber. 232 p. \$5.00. University of Colorado Press. Boulder. 1953.

plants of the central Rocky Mountains from Pikes Peak to the Rocky Mountain National Park and from the Plains to the Continental Divide. Approximately 1300 species are included, almost half of the total number found in Colorado. Introductory material includes accounts of plant zones, instructions for use of the keys, general descriptions of plants and their organs, directions for making plant collections, and a list of useful reference books.

The keys run first to families, then to genera and species. Both scientific and common names are given for the species. Explanations of the specific epithets are given in parenthesis following the Latin words. Brief statements of ranges are given, as "Rare, subalpine and alpine, on cliffs and rocky slopes"; "Extremely rare, vicinity of Devil's Head"; "Mesas and plains". Other information of local interest is also added, as, for example: "The most abundant summer-blooming violet in the montane and subalpine"; "The Colorado State flower"; "very poisonous to livestock". An illustrated glossary and comprehensive glossary and comprehensive index are most helpful features.

The book is small and light, therefore easily handled in the field and will doubtless have a very extensive use for many years to come.—
EARL L. CORE.

FERNS OF MARYLAND AND DELAWARE*.—One of the most scholarly of the numerous recent volumes on ferns of the eastern United States is Dr. Reed's new book, the result of a careful study of what the author estimates as approximately 5000 herbarium specimens of these plants. The book contains 32 pages of introductory material, including a history of the "pteridophytes" of the region, a general account of the ecological distribution of the group, a discussion of the relationships of ferns and "fern-allies", the life cycle of a typical fern, and a description of the organography of the sporophyte. An extensive index to the synonymy of the scientific names appears as an appendix. A glossary of difficult terms is included, as well as a bibliography of pertinent literature. Finally, an index is provided for the entire book.

A preliminary key leads to the families of pteridophytes and under each family of more than one genus other keys are provided. The genera are described concisely in short paragraphs, then each species is presented in detail, with general remarks, technical description, general distribution and distribution within the area. Numerous photographs provide illustrations of each species and of many of the

*The ferns and fern-allies of Maryland and Delaware, including District of Columbia. Clyde F. Reed. xviii + 286 p. \$3.00. Reed Herbarium, Baltimore 34. 1953.

varieties. These show habitats, gross appearance, and enlarged views of certain features, particularly the spores. Outline maps show by dots or other symbols the location of each station represented by a herbarium specimen. In all, there are 271 separate figures and 58 maps. The illustrations are quite clear and have been carefully selected.

The book is privately published and is sold at the Reed Herbarium, 10105 Harford Road, Baltimore 34, Maryland. The Reed Herbarium is a collection of 80,000 specimens of plants assembled by Dr. Reed and collaborators from all over the world. Dr. Reed, now an instructor in biology at the Baltimore Junior College, received the A.B. degree in 1938 from Loyola College, the M.A. in 1940 from Johns Hopkins University, and the Ph.D. in 1942 from Harvard University.

The book is attractive in appearance, well-bound, and the text is quite free from typographical errors. Since many of the ferns and fern allies described and photographed are found throughout the eastern United States, the book is certain to be of value to students of these plants in the entire area.—EARL L. CORE.

WILD FLOWERS OF WESTERN PENNSYLVANIA.*—In this work, published December 1, a master botanist and a master painter have combined their talents and efforts to produce a botanical masterpiece that will likely take its place among the finest books of its class ever produced. Its publication has been made possible through the generosity of the Buhl Foundation.

The two volumes have been printed on a large-size page, 10¼" x 14", to permit life-size representation of the wild-flower paintings. Paper and binding are of a high quality.

Volume 1 contains 600 pages of information concerning about 2,000 species, including keys, family, generic and specific descriptions, ecology, and distribution. The more important species are illustrated with 146 range maps. About 75 introductory pages cover soils, climate, physiographic and topographic history, geology, plant geography, the historic development of botany in the region, a glossary, a gazetteer, a list of collectors and authorities, a systematic list of plant families, a key and a bibliography. The data presented were assembled over a period of more than 50 years of intensive study by Dr. Jennings. Dr.

*Wild Flowers of Western Pennsylvania and the Upper Ohio Basin. O. E. Jennings, illus. by Andrey Avinoff. 2 vols. \$60.00. University of Pittsburgh Press. Pittsburgh.

Fernald spoke of this work as the "most comprehensive study yet made of a single botanical region".

Volume 2 contains gravure reproductions of 200 water color plates, including 253 species of wild flowers, painted by Andrey Avinoff life-size from living plants selected by Dr. Jennings. The legends describing the water colors were written by Dr. Jennings and give informal descriptions of the plants and the localities where they were collected. It is quite likely that these plates themselves will some day be reproduced and framed as works of art, in the manner that Audubon's paintings are used today.

Through many of the years when this work has been under preparation, the author of this review has been happy to have had the privilege of collaborating with Dr. Jennings, particularly with respect to that portion of the "Upper Ohio Basin" lying in West Virginia. We are now delighted to have Dr. Jennings' fine production available for reference in our own work on the flora of West Virginia, and it is a source of great pride that this area is now represented by perhaps the most sumptuous "local flora" ever published.—EARL L. CORE.

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